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*TRANSLATION*

FORM WORK FOR PRODUCING CONTAINER-SHAPED CONCRETE STRUCTURES, SUCH AS  
SILOS OR THE LIKE  
[Schalung zur Herstellung behälterförmiger Betonbauten, wie Silos oder  
dergleichen]

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The invention relates to form work for producing container-

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→ shaped concrete structures, such as silos or the like, in which two form work pieces are provided which are arranged displaceably in the direction of their central axis at a distance to one another that corresponds with the wall thickness of the container, and which are circumferentially closed, whereas the form work pieces are directly or indirectly arranged on a shared support frame, which is held displaceably on at least one guide rod.

To date, to produce especially high containers of concrete, such as, for instance, silos for grain storage or fermented feed silos, in most cases, individual panels have been used as form work, which had to be configured according to the respective curvature radius of the containers that were to be produced. These panels are made of relatively strong sheet iron and have flanges in their edge areas in the way of angular profiles at which they are connected with each other. The many individual panels must be connected with each other according to the circumference of the container by means of clamp braces. After a layer of such panels is poured, the next layer of panels is placed on it, whereas these must, in turn, be connected with one another. Furthermore, the individual panels are also connected with each other on the front side, so that, now, two or more overlying panel layers are firmly clamped together.

The production of containers of some height takes a lot of time because, according to S.I.A. standards, if regular cement is used, three ← days of a wait is required and, if special cement is used, two days must

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\* Number in the margin indicates column in the foreign text.

elapse before they are stripped. When the time has come, the bottom-most row of panels is released and placed on the subjacent row of panels. However, in this process, all of the individual panels must be detached from each other, first, and then reconnected.

This familiar form work method not only calls for an extraordinary expenditure of time and labor, but a high material expenditure also /2 plays a part.

Because such form work of the familiar kind is dangerous with a construction height in excess of 8 meters, specialized staff is often required for this form construction and form removal work, which substantially increases the construction costs.

The transportation and handling of such form panels is extremely difficult due to the great number that is required and because of their substantial weight.

However, form work has also become familiar to the art in which two form work pieces are provided which are arranged displaceably in the direction of their central axis at a distance to one another that corresponds with the wall thickness of the container, and which are circumferentially closed. With these familiar designs, the raising of the form pieces is carried out by hydraulic systems, or by means of a rack-and-pinion gear. However, the hydraulic systems make such form work more expensive and are associated with a greater maintenance expenditure.

Even work platforms workers can walk on do not offer an option for flawless, rapid, and low-risk work processes.

Also, form work for silos with two circumferentially closed form work pieces is already familiar to the art which is attached to a support that is held on a guide rod. The movement of the form work occurs via plungers which are hydraulically supplied and which grip the frame. Due to this measure, a special facility is required to generate the pressure of the hydraulic fluid. The movement of the form work is also limited by the stroke of the plunger. As a result, with a great form work height, a repeated securing and after-gripping of the plunger, as well as of the pressure cylinder, is required. Along the internal form work pieces, boards are placed on the rails which extend radially outward on which a rail rests to guide a movable tipping wagon. Additional rods are hung on the rails which carry scaffolds. These are attached both along /3 the inside and along the outside form work pieces and are situated substantially below the upper edges of the form work pieces. This makes for unfavorable and cumbersome working conditions because, e.g., when the concrete mix is distributed between the form work pieces, the laborers cannot gain an oversight of the process from above. On such scaffolds, laborers only have little freedom of movement and the distances these laborers must travel are very long because they can only move along the circumference of the form work. Moreover, the guide supports for the iron reinforcements enormously impede these workers. Due to the required stiffening braces, work on the scaffold is only possible with the greatest impediments.

Due to the scaffolds for the workers, which extend on the outside of the form work, several silos cannot be placed directly (at a distance

of about 10 m) adjacently to each other, which, in many cases, is required because of confined space, however. To get from the outside support frame to the inside one, or to reach the support frame which is located near the guide rod, is associated with danger, especially, in the case of some greater construction heights. ←

Also, a sliding molding with a work scaffold has become familiar to the art. This design is, however, only suited for residential construction where individual floors are built, respectively, so that the form work can always be supported on the ground or the ceiling of the lower floor. To lift the form work, builders' hoists are required on the four corners of each room. However, this is associated with quite substantial disadvantages of this design. At all times, this requires as many workers to lift the form work as the number of builders' hoists that are used. Moreover, the workers always have to leave the scaffold and initiate the lifting process underneath them. The danger that the form work will tilt is especially acute because it is hardly possible that all builders' hoists will be simultaneously extended by the same protraction value. ←

Previous form work of this kind could only be handled with great expenditure and the work with such form work could be viewed as extremely dangerous, especially, at great heights. Moreover, the familiar designs called for enormous expenditures for materials and their assembly. ←

The invention has made it its objective to create form work for the production of containers, particularly, silos or the like, which can also

be erected, moved, or removed, by one single worker. Moreover, with the inventive form work, the above-listed disadvantages are to also be avoided.

This is managed in that the support frame is designed as a walk-on platform and in that a manual or motor-driven winch, or a grab winch, is mounted to move the support frame along the guide rod.

This inventive configuration provides a secure work surface because the opening of the container is always closed off. Thus, the filling of the form work with concrete is also substantially easier compared to the familiar form work types where only a few wooden boards were laid on them and a danger of accidents existed, especially, at greater heights.

The concrete can be poured in with drivable receptacles from the platform. As a result of the fact that the manual or motor-driven winch, or /4 the grab winch, is arranged on the support frame, it can conveniently be operated from the platform, so that the form work removal, pulling the form work further on, and the erection of the form work can be carried out by one single worker. Moreover, the inventive platform may be used as form work for the upper cover plate of a silo.

Form work designed in accordance with the invention will be explained yet more closely in the following description by means of the drawings, but the invention shall not be limited to the example specified.

Shown are:

Figure 1, a section through the form work and the support frame;

Figure 2, a top view of the form work and the platform;

Figure 3, a view of the suspension eyelets and a spacer;

Figures 4 and 5, panels forming the platform, or the placement of the same;

Figures 6, 7, and 8, the connection or bracing of the form work pieces;

Figure 9, a connection option between the individual guide rods;

Figure 10, a clamping jaw on an iron reinforcement; and,

Figure 11, a guard arranged on an external form work piece.

The form work is comprised of an external form work piece (1) and an internal form work piece (2). The two form work pieces (1 and 2) are designed in the shape of bands or strips and circumferentially closed and are made of one or several pieces which are screwed together. The form work pieces (1, 2) are in a direct or indirect connection with a support frame (3), whereas this support frame (3) is held on a guide rod (4) which is situated on the central axis of the form work pieces by means of a collet (5). The support frame (3) is equipped with rails (6) which, in the configuration example, run radially towards the outside and which serve as a support for the panels (7) which, in turn, constitute a walk-on platform (8). On these panels (7), rods (9) are attached by means of brackets (10) which grip into suspension eyelets (11 and 12) on the form work pieces (1, 2) and, thereby, hold the form work pieces (1, 2). Rods which protrude beyond the edges of the form work pieces, which are equipped with two slots (14, 15), serve as spacers (13). The circumferential contours of the platform (8) nearly corresponds with that of the masonry (16), so that the correct circular shape of the container is respectively



provided by the spacers (13) resting against the circumferential contour of the platform (8).

A manual winch (17) for raising and lowering the form work pieces or the support frame is shown in Figure 1, whereas, by shortening the draw rope (18), which is guided over a rope pulley that is located in the upper end area of the guide rod, the form work pieces (1, 2) and the support frame (3), and, therefore, the platform (8), are raised up.

To secure the support frame on the guide rod (4), a lever (19) is sluably carried on the support frame (3), which, on its one end, is equipped with a ring (19') that reaches around the guide rod (4), whereas this ring (19') reaches around the guide rod with only little play. The end of the draw rope (18) is attached in the area which is located opposite to the ring (19') with regard to the bearing (19'''). A spring (19'') which opposes the tension of the rope grips a free end of the lever. If the rope (18) tears, the spring (19'') brings about a tilting of the ring /5 (19''), so that the support frame, and, therefore, the form work pieces cannot fall down. However, as the support frame is raised, the ring is pressed into a horizontal position on the collet (5), so that it cannot tilt and, therefore, does not exert a braking effect.

Figure 3 depicts the configuration of the suspension eyelets (11 and 12) and of the spacers (13). The suspension eyelets (11 and 12) are configured in the way of slots in the circumferential direction (oblong slots 20, 21), so that, when the form work pieces are released, or clamped, or screwed, they can move in the circumferential direction of the masonry.

The rod (9) is attached to the panel or to the rails (6) by means of a bracket (10).

The individual panels (7) for the formation of the platform (8) are equipped with lateral studs (22, 23) which serve to secure them against a lateral shifting in relation to the rails (6) (Figures 4, 5). The panels are made of wood, whereas the individual boards (24) are connected with the studs (22, 23).

The connection at a break in the external form work piece (1) occurs by means of a wedge (26), which exhibits springs (27) that extend in the shape of a wedge, which grip into notches (25) that are provided on the form work piece. As a result, the form work piece (1) is pulled together (Figure 6).

At a break in the internal form work piece (2), one notch (28, 29), each of which extends over the width of the form work piece (2), is provided, respectively, the depths (30, 31) of which extend at an acute angle in relation to the vertical. These notches are devised to take up a panel (32), the lateral areas (33) of which converge at an acute angle in relation to one another. To lift out and hammer in a panel (32), a lug (34) is arranged in its upper area (Figures 7 and 8).

Depending upon the height of the building structure, various lengths are required for the guide rod (4) which brings about the guide effect.

In this process, a configuration is useful if, within two or more pipes which are connected to each other, that are devised as guide rods, bolts (35) are provided in the area of the pipe ends.

Figure 10 depicts clamping jaw (36) which is attached to a vertically extending bar reinforcement (37). These clamping jaws (36) serve to adjust the protraction height of the form work pieces (1, 2).

To guarantee the particular safety of people who are working on the platform (8), pipe pieces (38) can be welded or riveted on the external form work piece (1), which serve to take up guard barriers. In the configuration example in accordance with Figure 11, a rod (39) is provided which carries a protective wire mesh or a piece of pipe (40) by means of suspension eyelets (41).

The process in the handling of the form work is as follows: The guide rod (4) is anchored or placed in the central axis of the silo which is to be erected. Now, the support frame (3) can be slipped on the rod (4) on which the rails (6) are to be attached. The panels (7) forming the platform rest on the rails (6) in their edge areas. Brackets (10) are provided on these panels (8), which take up the rods (9) after the external and internal form work pieces (1, 2) have been mounted. Now, these rods (9) connect the brackets (10) which are arranged on the panels (7) with the suspension eyelets (11, 12) of the form work pieces (1, 2). The form work pieces now hang on the support frame (3), which is held on the guide rod (4). To chuck the form work pieces, the following is provided: /6  
The external form work piece (1) is chucked by means of the wedge (26).

The internal form work piece is pressed apart by means of the wedge-shaped panel (32), which grips into a notch in a break in the form work piece, or is hammered in. To obtain the desired circumferential contour of the silo and the specific wall thickness, the spacers (13) are placed on the

form work pieces (1, 2), which then further rest on the circumferential contour of the platform.

Now, the concrete work can begin, whereas the large work surface that is constituted by the platform (8) facilitates rapid and low-risk work.

As a rule, after the strip that was poured last has dried, or after it has set completely, the form work can be prepared for the next pouring in the way of a strip after two to three days.

The form work removal is handled as follows: First, the spacers (13) are taken off, whereupon the wedge (26) and the wedge-shaped panel (32) are then removed. By simply tapping against it, the form work detaches from the concrete and now rests against it, so that it is freely movable.

Because, during the detachment of the form work pieces (1, 2), a slight lateral displacement of the same occurs, oblong slots (20, 21) are provided on the suspension eyelets (11, 12). Now, by turning the manual winch (17), the support frame (3), including the platform and the form work, can be lifted, whereas, prior to this process, clamping jaws (36) are mounted (Figure 10) on the bar reinforcements (37) which extend in parallel to the central axis to precisely delimit the protraction. These clamping jaws (36) are clamped fast at a distance from the previous concrete height which is somewhat less than the height of the form work pieces. The measurements for the vertical structural setup of the silo can also be taken on these clamping jaws, e.g., by means of a spirit level, which is placed on two such clamping jaws. Depending upon the height of the

building structure, additional rods are set on or stuck into the rod (4) which lies on the central axis of the form work.

Now the process can begin anew. The form work pieces are chucked and the spacers are stuck on. The form work process only takes little time and can also be carried out by one single worker, which is not only of great advantage where prices are concerned, but also with regard to safety and technical efficiency.

Due to the special configuration of the platform, it is possible to concrete the upper cover plate of a silo while using the platform as form work.

To cover various diameters of containers with the same form work pieces, telescoped, pull-apart, lockable bands could also be used, for instance.

Furthermore, it is conceivable that the individual band- or strip-shaped form work pieces are assembled from individual metal sheets, which may, for instance, be welded, riveted, or screwed together. The screwing together of individual band pieces is of particular significance during transportation because the form work pieces can be taken apart.

Moreover, the provision may be that, in the central axis of the form work pieces, a toothed rod is provided, on which the support is lifted up by means of toothed wheels. Moreover, the rod would not have to /7 be located in the central axis, or several guide rods could be attached depending upon the size of the silo. Instead of the wedge for the external form work piece, clamp chucks could also be provided, for instance.

To raise up the support frame and, thus, the platform and the form work, it is also possible to use a motor-driven winch or a grip winch.

To realize a circular silo cross-section, it is also possible to configure the panels (7) constituting the platform so that they can be moved radially outward, so that, during the concrete work, they will uniformly press the internal form work piece (2) towards the outside on the whole circumference.

The inventive form work is, of course, not only appropriate for producing silos, but also for receptacle-type structures or structural components of a different design.

#### Patent Claim

Form work for producing receptacle-type concrete structures, such as silos or the like, in which two form work pieces are provided which are arranged displaceably in the direction of their central axis at a distance to one another that corresponds with the wall thickness of the container, and which are circumferentially closed, whereas the form work pieces are directly or indirectly arranged on a shared support frame which is held displaceably on at least one guide rod, characterized in that the support frame is configured as a walk-on platform (8) and a manual or motor-driven winch (17), or a grip winch, is mounted on it to move the support frame (3) along the guide rod (4).

#### Sub-Claims

1. Form work in accordance with the Patent Claim, characterized in that the support frame (3) has rails (6) which extend radially outward,

whereas panels (7) are laid on these rails which, preferably, can be connected to each other and secured against shifting.

2. Form work in accordance with the Patent Claim and Sub-Claim 1, characterized in that the panels (7) are configured in the shape of a sector, so that they respectively rest on two adjacent rails (6) which extend radially outward.

3. Form work in accordance with the Patent Claim, characterized in that the form work pieces (1, 2) are displaceable in relation of the support frame (3) in the circumferential direction (Figure 3).

4. Form work in accordance with the Patent Claim and Sub-Claims 1 to 3, characterized in that suspension eyelets (11, 12) are provided on the form work pieces (1, 2), into which rods (9) grip that are solidly on the support frame (3), but detachable.

5. Form work in accordance with Sub-Claims 3 and 4, ← /8  
characterized in that the suspension eyelets (11, 12) are configured in the way of slots in the circumferential direction of the form work pieces (1, 2).

6. Form work in accordance with the Patent Claim, characterized in that the circumferential contour of the platform (8) nearly corresponds with the internal contour of the internal form work pieces (2).

7. Form work in accordance with Sub-Claim 6, characterized in that spacers (13) are provided for the form work pieces which protrude beyond the internal form work piece (2) and which rest on the circumferential contour of the platform (8).

8. Form work in accordance with the Patent Claim, characterized in that the pull rope (18) which starts out from the manual or motor-driven winch (17) is guided over a rope pulley which, preferably, is arranged on the free end of the guide rod (4) and the rope end is attached in the area of the support frame (3) which is located opposite to the manual or motor-driven winch (17) in relation to the guide rod (4).

9. Form work in accordance with the Patent Claim and Sub-Claims 1 and 2, characterized in that the panels (7) constituting the platform (8) can be displaced outward in radial direction and are configured, so that they can be locked in place.

10. Form work in accordance with the Patent Claim or any of the previous Sub-Claims, characterized in that the guide rods (4) are formed from two or more interconnectible or telescoping pipes.

11. Form work in accordance with the Patent Claim, characterized in that, on iron reinforcements (37) extending in the displacement direction of the form work pieces (1, 2), jaws (36) are provided, which are displaceable and can be chucked together with them.

12. Form work in accordance with the Patent Claim, characterized in that, on the support frame (3), in the area of the guide element (5), a lever (19) is slidably carried, which carries a ring (19') that reaches around the guide rod on its one end and that, on its other end, a spring (19'') grips, whereas between the point of the spring's (19'') grip and the bearing of the lever (19), a pull rope (18) is attached for raising and lowering the support frame (3).



13. Form work in accordance with Sub-Claim 12, characterized in that the ring (19') which is arranged on the lever (19) encloses the guide rod (4) with little play when the lever (19) is loaded due to the weight of the support frame of the form work and the platform.

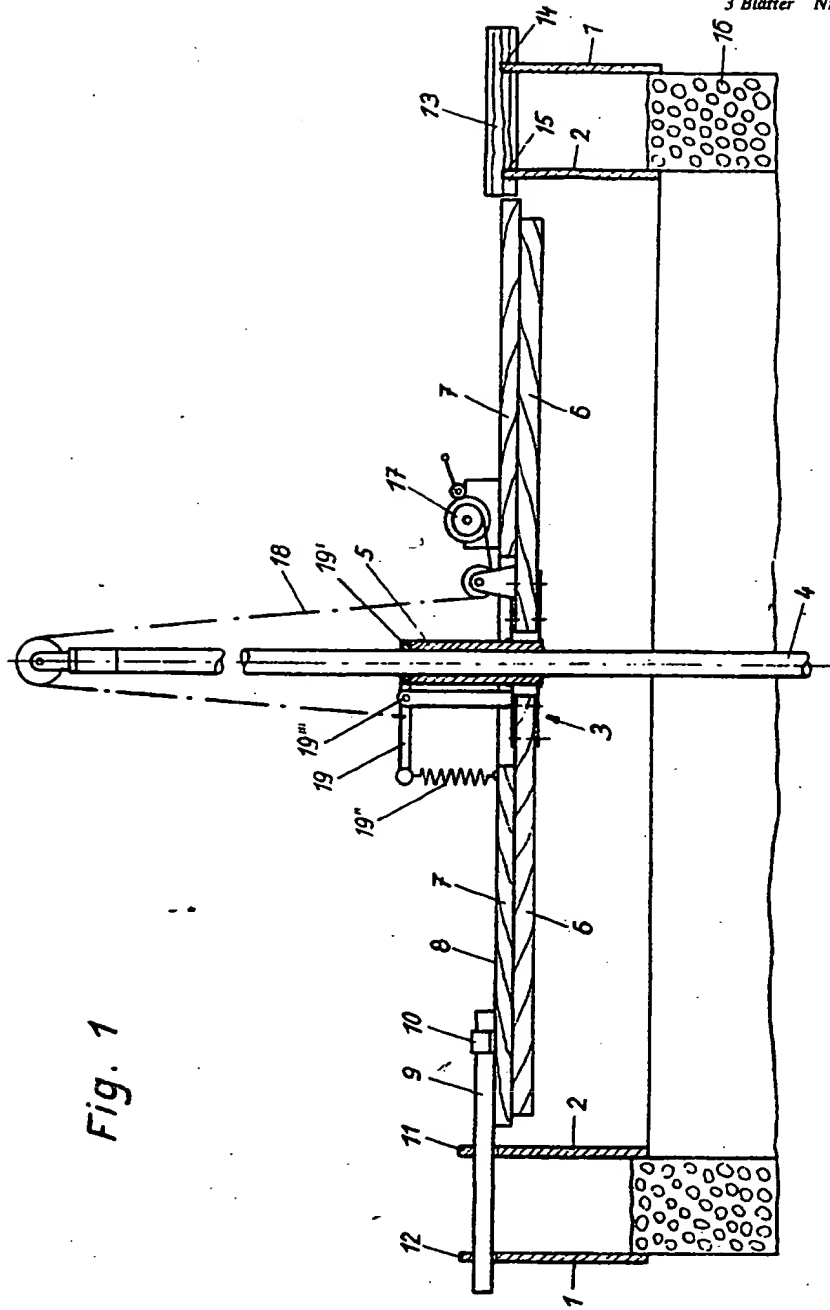


Fig. 1

Fig. 2

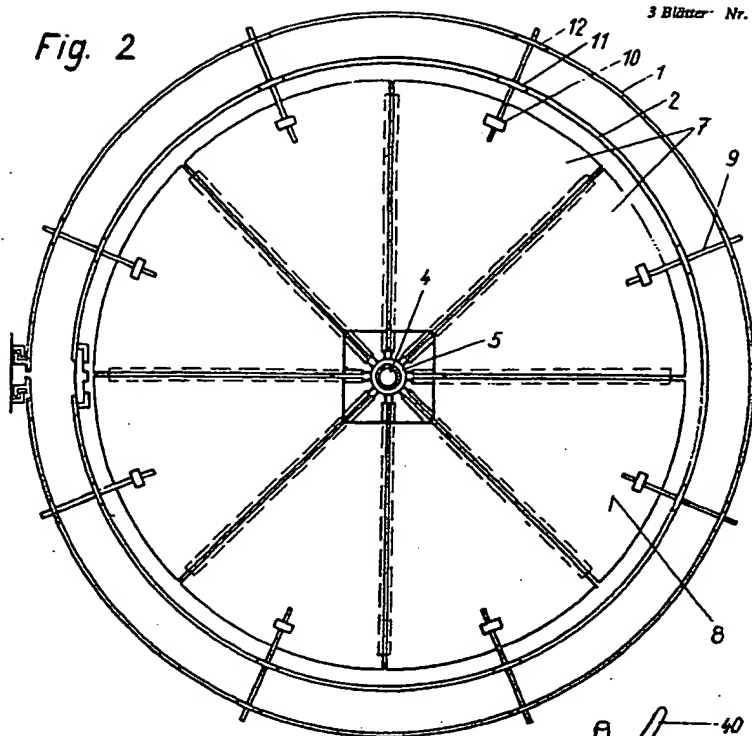


Fig. 10

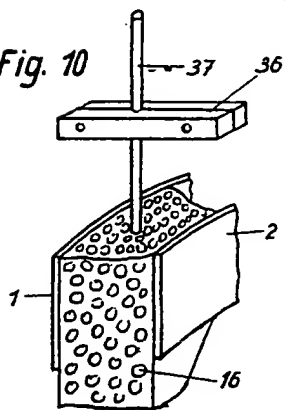


Fig. 11

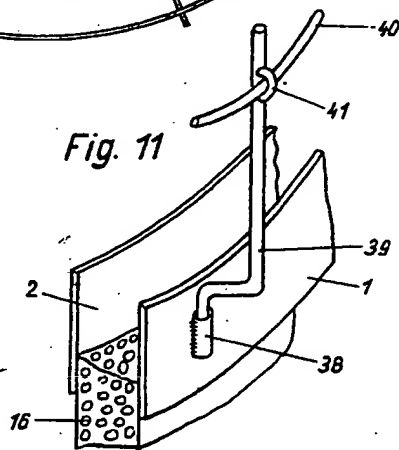


Fig. 3

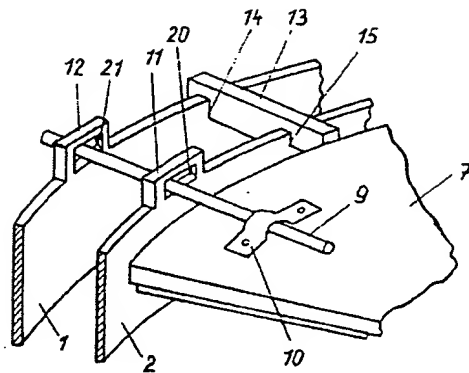


Fig. 4

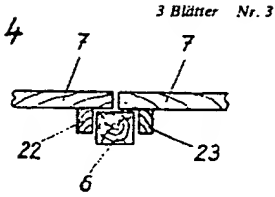


Fig. 5

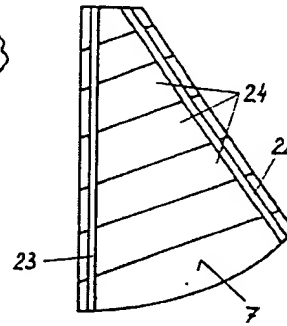


Fig. 6

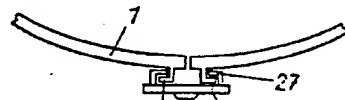


Fig. 7

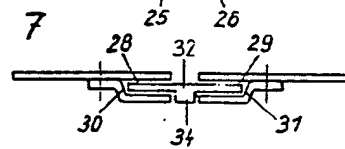


Fig. 8

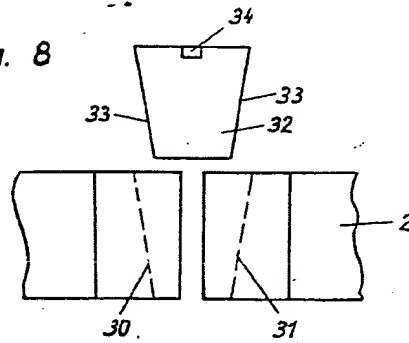
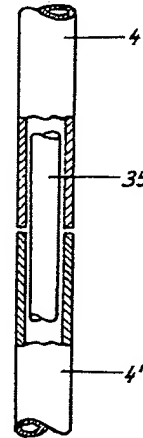


Fig. 9



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